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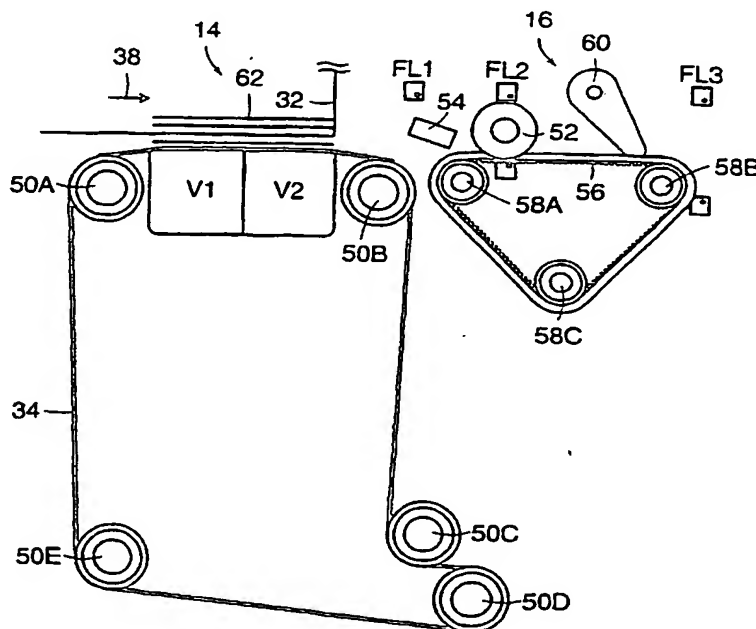
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- (21) International Application Number: PCT/US00/41075
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- (30) Priority Data:
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- (71) Applicant: LOCKHEED MARTIN CORPORATION [US/US]: 1801 State Route 17C, Owego, NY 13827-3998 (US).
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- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
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[Continued on next page]

(54) Title: SINGULATION MECHANISM



(57) Abstract: A singulation mechanism is provided for use in a handling system for mail or other substantially flat articles, the mechanism having a singulation head (14) with a drive mechanism which, in accordance with a first aspect of the invention, initially moves an article (62) pressed there against with high acceleration, interrupts the drive to the article for a brief instant and then moves the article again at high acceleration, a take-away mechanism (16) removing the article exiting the head. In accordance with a second aspect of the invention, movement at a high acceleration is imparted to the article pressed against the singulation head only when the head is energized and substantially no movement is imparted when the head is not energized. More specifically, the singulation head may include a belt (34) driven over a pair of vacuum chambers (V1, V2), with the trailing vacuum chamber (1) being initially energized to draw the article against the belt and move the article with high acceleration to a position detected by

a first detector (FL1), at which time the trailing vacuum chamber (V2) is turned off and the leading vacuum chamber turned on to again grab the article and move it to the take-away mechanism with high acceleration. This two-step acceleration process is effective for shaking free doubles from the article being singulated. The belt has a substantially friction-free surface in contact with the article to assure that movement is imparted to the article only when a vacuum chamber is turned on. The mechanism includes additional features, including a double resolver head (54), for preventing the passage of doubles to the take mechanism.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/41075

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65H3/12 B65H1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 018 057 A (BELL TELEPHONE MFG ;INT STANDARD ELECTRIC CORP (BE)) 29 October 1980 (1980-10-29) page 2, line 8 - line 32 page 3, line 23 -page 6, line 27 figures 1,2	1,6,7, 11-13,28
X	US 5 391 051 A (ROCH OLIVIER ET AL) 21 February 1995 (1995-02-21) column 2, line 24 - line 54 column 3, line 26 -column 4, line 54 figure 1 claims 1,2	1,9,11, 12,28
A	US 5 507 480 A (MARTIN PHILIPPE ET AL) 16 April 1996 (1996-04-16) the whole document	1,9,11, 12

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

22 February 2001

Date of mailing of the international search report

14. 05. 01

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

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PCT/US 00/41075

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 606 305 A (DEBACKERE RAYMOND GILBERT REMI ET AL) 20 September 1971 (1971-09-20) column 4, line 58 - line 60 ---	2
A	US 3 817 516 A (LAZZAROTTI S ET AL) 18 June 1974 (1974-06-18) column 5, line 18 - line 45 figures 1,3,6-9 ---	7,8
A	US 4 523 753 A (TSUDA KIYOSHI ET AL) 18 June 1985 (1985-06-18) column 3, line 26 - line 32; figure 1 ---	9
A	US 5 290 022 A (ASTIER JEAN-LUC ET AL) 1 March 1994 (1994-03-01) column 3, line 65 - line 68; figure 1 -----	11,14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/41075

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-14, 28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-14,28

1.1. Claims: 1-14

Singulation mechanism with first and second vacuum chambers, wherein the vacuum pressure is approximately 10 Hg to 25 Hg, depending at least in part on the selected weight range for the articles to singulate.

1.2. Claim : 28

A singulation head with a drive mechanism which, when energized, moves a first article in a stack to be singulated at high acceleration, and, when not energized, imparts substantially no movement to a said article.

2. Claims: 15-21

Singulation mechanism wherein the singulation head includes a drive mechanism which initially moves an article pressed thereagainst with high acceleration, interrupts drive to said article for a brief instant, and then moves the article again at high acceleration.

3. Claims: 22-24,25-27

Singulation head for use in a handling system for substantially flat articles with a belt having a first side with a substantially friction-free surface and a belt for use in such a singulation head.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/41075

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0018057 A	29-10-1980	AU 5767080 A BE 882940 A DE 3065752 D ES 250240 Y JP 1253732 C JP 56012241 A JP 59028504 B	30-10-1980 24-10-1980 05-01-1984 01-11-1981 26-02-1985 06-02-1981 13-07-1984
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(51) International Patent Classification⁷: **B65H 3/12, 1/02**

TAYLOR, Lou, B.: 579 Barton Road, Apalachin, NY 13732 (US).

(21) International Application Number: PCT/US00/41075

(22) International Filing Date: 4 October 2000 (04.10.2000)

(74) Agent: **KRANSDORF, Ronald, J.:** Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).

(25) Filing Language: English

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(26) Publication Language: English

(30) Priority Data:
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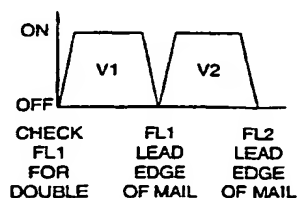
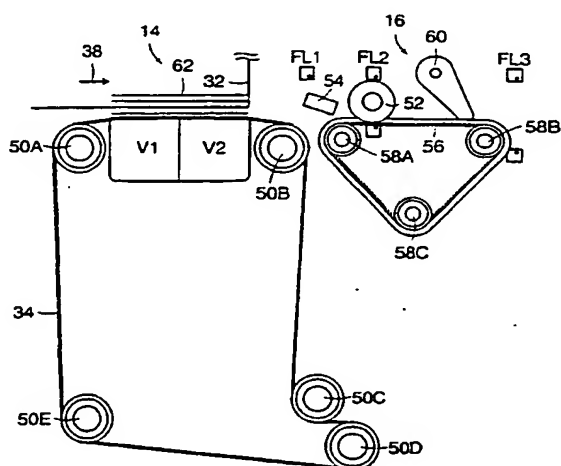
(71) Applicant: **LOCKHEED MARTIN CORPORATION**
[US/US]: 1801 State Route 17C, Owego, NY 13827-3998 (US).

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors: **CERA, George, C.:** 449 Glendale Drive, #64, Endicott, NY 13760 (US). **BLACKWELL, Wayne, M.:** 169 Conklin Hill Road, Chenango Forks, NY 13746 (US).

[Continued on next page]

(54) Title: SINGULATION MECHANISM



(57) Abstract: A singulation mechanism is provided for use in a handling system for mail or other substantially flat articles, which articles may have a significant variation in thickness, the mechanism having a singulation head (14) with a drive mechanism which, in accordance with a first aspect of the invention, initially moves an article (62) pressed there against with high acceleration, interrupts the drive to the article for a brief instant and then moves the article again at high acceleration, a take-away mechanism (16) removing the article exiting the head. In accordance with a second aspect of the invention, movement at a high acceleration is imparted to the article pressed against the singulation head only when the head is energized and substantially no movement is imparted when the head is not energized. More specifically, the singulation head may include a belt (34) driven over a pair of vacuum chambers (V1, V2), with the trailing vacuum chamber (V1) being initially energized to draw the article against the belt and move the article with high acceleration to a position detected by a first detector (FL1), at which time the trailing vacuum chamber (V1) is turned off and the leading vacuum chamber (V2), turned on to again grab the article and move it to the take-away mechanism with high acceleration. This two-step acceleration process is effective for shaking free doubles from the article being singulated. The belt has a substantially friction-free surface in contact with the article to assure that movement is imparted to the article only when a vacuum chamber is turned on. The mechanism can include additional features, including a doubles resolver head (54), for preventing the passage of doubles to the take-away mechanism, and one or more sensors that determine the stack pressure at which articles are pressed against the belt, such a bottom pressure sensor (46B).

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